

RESTRICTED CIRCULATION

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AN INITIAL ANALYSIS OF THE WARWICKSHIRE OUTBREAK OF FOOT AND MOUTH DISEASE OF 1967.

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INTRODUCTION

A study of the 1967 Hampshire outbreak of Foot and Mouth disease was made by Gloster (Agricultural Memorandum 980). This provided data allowing a quantification of the relationship between the probability of infection, the number of cattle exposed and the degree of challenge. The Warwickshire outbreak, centred on Stratford-upon-Avon, differed from that in Hampshire in that the extent to which secondary spread occurred was much more limited. It was felt that an examination of the prevailing meteorological conditions at the time of the outbreak may at least partially explain this difference. It would also provide a test of the general validity of the relationships established in Ag. Mem. 980.

THE OUTBREAK

Between the 4th and 7th September 1967 (on which date the last outbreak occurred) Foot and Mouth disease was confirmed on four premises near Stratford-upon-Avon. The infection originated in a herd of pigs which had been fed unboiled swill containing imported meat scraps. On 4th September disease was confirmed, on clinical findings, in cattle on farm premises at Snitterfield, Nr Stratford-upon-Avon. On the same day the disease was also confirmed in both cattle and pigs on an adjacent farm. This proved to be the primary outbreak with disease having been present for 7-10 days. On 6th September disease was confirmed in sheep on premises adjacent to the initial case and a final case was confirmed on 7th September in cattle on premises $1\frac{1}{4}$ miles away from the initial outbreak. In the four outbreaks a total of 268 cattle, 72 sheep and 52 pigs were slaughtered; of these 30 cattle, 1 sheep and 10 pigs were affected with the disease.

DATA USED

Three hourly observations from Pershore (about 15 miles SW of Stratford-upon-Avon) were used for the period 23rd August to 4th September. Hourly observations from Elmdon were also used for the period 1st to 4th September to check the sensitivity of the results to the frequency of observations. Results from the two analyses were very similar.

Disease information was obtained from an earlier investigation into the outbreak which had been carried out a AVRI. A large scale patrol map showing all stock in the surrounding area was also obtained from this source.

ANALYSIS

Values for daily virus emission were estimated from those suggested by Gloster and others (1981), and for each herd of cattle shown on the patrol map the daily inhaled virus doseage was estimated for the period 23rd August to 3rd Sept.

The model used was similar to that described by Gloster et al (1981), but had been modified to exclude virus transmission when relative humidities were below 60%. Experimental work has shown that Foot and Mouth disease virus viability is low when relative humidities are below 60% (Gloster et al 1981). Relative humidities during the Hampshire outbreak did not fall below this level, but daytime humidities were often lower than this during the Warwickshire outbreak. A higher threshold of 70% relative humidity was also tried, but this had little effect on predicted virus dosages as there were relatively few occasions in either outbreak when the relative humidity was between 60 and 70%.

Table 1 shows the likely period of infection, the maximum daily inhaled dosage during this period and the number of stock affected for each of the secondary outbreaks. The maximum challenge received by each of the infected premises was in excess of one infectious unit per day per cow. However, many other herds received dosages similar to this but did not become infected.

TABLE 1.

Period of infection, maximum daily dosage and number of stock affected for secondary infected premises.

Premises	Likely Period of Infection	Maximum Daily Inhaled Dosage (IU/cow)	Number of Stock Affected
D.F. 9735	23 Aug - 29 Aug	1.7	9c out of 68c
D.F. 9737	23 Aug - 30 Aug	2.1	1s out of 47s
D.F. 9738	23 Aug - 1 Sep	2.2	1c out of 102c

Tables 2(a) and (b) show the maximum daily inhaled dosage received on a herd size basis for the Warwickshire and Hampshire (Gloster, Agricultural Memorandum 980) outbreaks. The smaller number of farms receiving dosages of less than 1 I.U. in the case of the Warwickshire outbreak is due to the limited area of the investigation; thus many of the farms which may have received small dosages lay outside the area studied. The total number of farms receiving dosages of between 1 and 10 I.U. was the same for both outbreaks, but the distribution of farm sizes is rather different. In the Warwickshire area the number of farms in each of the herd size categories is similar, whereas in Hampshire more than half of the holdings had herds of less than 20 cattle.

TABLE 2(a)

Maximum Daily Inhaled Infectious Dosage (I.U) by Size of Farm
- Warwickshire Area

MAX. DAILY DOSAGE (Infectious Units)	HERD SIZE					ALL
	≤ 20	21-40	41-60	61-100	>100	
< 0.1	2	2	0	0	0	4
0.1 - 1.0	8	3	4	4	10	29
1.0 - 10.0	6	12	6	8	4	36
>10.0	2	0	1	0	2	5
ALL	18	17	11	12	16	74

TABLE-2(b)

Maximum Daily Inhaled Infectious Dosage (I.U) by Size of Farm
- Hampshire Area

MAX. DAILY DOSAGE (Infectious Units)	HERD SIZE					ALL
	≤ 20	21-40	41-60	61-100	>100	
< 0.1	8	4	0	4	1	17
0.1 - 1.0	29	8	7	4	1	49
1.0 - 10.0	22	4	2	6	2	36
>10.0	12	5	3	5	4	29
ALL	71	21	12	19	8	131

Tables 3(a) and (b) show the number of herds infected for each size of holding for maximum dosages of 1.0 - 10.0 I.U. and >10.0 I.U. for the two outbreaks. There was virtually no infection of herds of less than 40 cattle in either outbreak, but for herds of over 40 cattle the differences in levels of infection were very marked, with a high proportion of larger herds becoming infected in Hampshire, but very few in Warwickshire. Of all herds receiving a maximum dosage of more than one infectious unit, 15 out of 65 became infected in Hampshire compared to 3 out of 41 in Warwickshire, and for dosages greater than 10 infectious units the corresponding figures were 9 out of 29 in Hampshire and none out of 5 in Warwickshire. For herds of over 40 cattle receiving dosages greater than one infectious unit the rate of infection was around 65% in Hampshire compared to less than 14% in Warwickshire.

TABLE 3(a)

Number of Herds Infected - Warwickshire

MAX. DAILY DOSAGE (Infectious Units)	HERD SIZE					
	≤20	21-40	41-60	61-100	>100	ALL
1.0 - 10.0	0	0	1	1	1	3
>10.0	0	0	0	0	0	0
ALL	0	0	1	1	1	3

TABLE 3(b)

Number of Herds Infected - Hampshire

MAX. DAILY DOSAGE (Infectious Units)	HERD SIZE					
	≤20	21-40	41-60	61-100	>100	ALL
1.0 - 10.0	1	0	2	3	0	6
>10.0	0	0	1	4	4	9
ALL	1	0	3	7	4	15

CONCLUSIONS

The reasons for the differences between the two outbreaks are not clear at present. One major difference between them was the time of year at which they occurred - winter in the case of the Hampshire outbreak whereas that in Warwickshire occurred in late summer. During the Warwickshire outbreak relative humidities were below 60% from mid-morning to mid-evening during most days for the period 23rd August to 3rd September with the exception of the first two days of the period and 1st September. During the Hampshire outbreak the relative humidity did not fall below 70% for any significant length of time during the period 29th December to 7th January. It is possible that spread occurred mainly during the daytime, which could explain some of the differences between the outbreaks, although there appears to be little experimental work to support this hypothesis at present.

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REFERENCES

Gloster, J. Agricultural Memorandum 980, Meteorological Office, Bracknell (unpublished)

Gloster et al (1981) Vet. Record 108, 370-372.